Review 27 Parametric Equations

$x = f(t)$ $y = g(t)$ describes a curve (2D)

usually given $\frac{dx}{dt}$, $\frac{dy}{dt}$ and $t_i, (x_i, y_i)$ initial condition

to solve for x_f & y_f, use FTC

acceleration: vector $\left\langle \frac{d^2x}{dt^2}, \frac{d^2y}{dt^2} \right\rangle$

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speed $= |\vec{v}| = \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}$

total distance (arc length) $= \int_a^b \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$

slope $= \frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$ $\qquad \frac{dx}{dt} \cdot \frac{dy}{dx} = \frac{dy}{dt}$

$\frac{d^2y}{dx^2} = \frac{\frac{d}{dt}\left(\frac{dy}{dx}\right)}{\frac{dx}{dt}}$

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Ex 1 $\frac{dx}{dt} = \sqrt{3t}$ $\frac{dy}{dt} = 3\cos\left(\frac{t^2}{2}\right)$

The particle is at position $(1, 5)$ when $t = 4$

a) find $\vec{a}(4)$

b) find $y(0)$

c) when does the speed first reach 3.5?

d) Find the total distance on $0 \le t \le 4$

e) Find the equation of the tan line at $t = 4$

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a) $\vec{a}(4) = \langle 0.433, -11.872 \rangle$

b) $5 + \int_4^0 3\cos\left(\frac{t^2}{2}\right) dt = 1.600$

c) $\sqrt{3t + 9\cos^2\left(\frac{t}{2}\right)} = 3.5$ $\qquad t = 2.225$

d) $\int_0^4 \sqrt{3t + 9\cos^2\left(\frac{t}{2}\right)}\, dt = 13.182$

e) $m = \left.\frac{\frac{dy}{dt}}{\frac{dx}{dt}}\right|_{t=4} = -.126$

$y = -.126(x - 1) + 5$

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